CLAIMS

1. Superconducting cable (1) having at least one phase comprising:

a) a layer (20) of tapes comprising superconducting material;

b) a tubular element (6) for supporting said layer (20) of tapes comprising superconducting material, said tubular element comprising at least one portion made of metallic material, and being in electrical contact with the layer (20) of tapes comprising superconducting material;

c) a cooling circuit, adapted to cool the superconducting material to a working temperature not higher than its critical temperature, comprising a fluid at a predetermined working pressure ranging between a minimum value and a maximum value;

wherein the deformation of said tapes comprising superconducting material, consequent to a temperature variation between the room temperature and the working temperature of the cable is lower than the critical deformation of the same tapes,

characterized in that a predetermined amount of conductive material of resistive type in electrical contact with the layer (20) of superconducting material is present, such that the maximum temperature reached by the superconducting material in case of short circuit is lower than the minimum temperature between the critical temperature of the superconducting material and the boiling temperature of said cooling fluid at the minimum working pressure of said fluid.

2. Superconducting cable (1) according to claim 1, characterized in that said layer of tapes is incorporated within a metallic coating (19).

3. Superconducting cable (1) according to claim 2, characterized in that said superconducting material comprises at least one reinforcing foil (21) made of metallic material.

4. Superconducting cable (1) according to claim 3, characterized in that said superconducting material comprises two reinforcing foils (21) made of metallic material coupled to opposite faces of said layer.

5. Superconducting cable (1) according to claims 3 or 4, characterized in that said superconducting material is essentially prestressed along a longitudinal direction.

6. Superconducting cable (1) according to claim 5, characterized in that the layer (20) of superconducting material of said at least one superconducting tape (18a, 18b) has a prestress degree along a longitudinal direction (γ) comprised between 0.05 and 0.2 %.

7. Superconducting cable (1) according to claim 1, characterized in that it comprises a plurality of superconducting tapes (18a, 18b) spirally wound on the surface of said at least one supporting tubular element (6) according to winding angles comprised between 5° and 60°.

8. Superconducting cable (1) according to claims 3 or 4, characterized in that the reinforcing foil (21) and the metallic coating (19) of said superconducting tapes (18a, 18b) consist of a metal selected from the group comprising: copper, aluminum, silver, magnesium, nickel, bronze, stainless steel, beryllium, and alloys thereof.

9. Superconducting cable (1) according to claims 1, 3 or 4, characterized in that said supporting tubular element (6) is essentially composite and comprises a first metallic material and a second material associated to said first material having a thermal expansion coefficient higher than that of said first material.

10. Superconducting cable (1) according to claim 9, characterized in that said first and second material are formed as adjacent annular sectors (16, 17).

11. Superconducting cable (1) according to claim 10, characterized in that said annular sectors (16, 17) are arranged one after the other.

12. Superconducting cable (1) according to claim 10, characterized in that said annular sectors (16, 17) are spirally wound according to a winding angle comprised between 5° and 50°.

13. Superconducting cable (1) according to claim 9, characterized in that said first metallic material is a metal having a resistivity at 77 K < $5*10^{-9}$ Ωm, a specific heat at 77 K > 10^6 J/m³K and a heat conductivity at 77 K > 5 W/mK.

14. Superconducting cable (1) according to claim 9, characterized in that said second material is a non metallic material having a thermal expansion coefficient higher than $17*10^{-6}$ $°C^{-1}$.

15. Superconducting cable (1) according to claim 14, characterized in that said second non metallic material is a plastics material selected from the group comprising: polyamide, polytetrafluoroethylene and polyethylene.

16. Conductive element (3) for superconducting cables (1) comprising at least one layer (20) of superconducting material incorporated within a metallic coating (19) supported by a tubular element (6) comprising a predetermined amount of metallic material with which the layer (20) is in electrical contact, said layer (20) of superconducting material is cooled by means of a cooling fluid to a temperature not higher than its critical temperature, characterized in that a predetermined amount of conducting material of resistive type is present in

electrical contact with the layer (20) of superconducting material, such that the maximum temperature reached by the superconducting material in case of short circuit is lower than the minimum temperature between the critical temperature of the superconducting material and the boiling temperature of said cooling fluid at the minimum working pressure of said fluid.

17. Method adapted to limit the induced stresses along a longitudinal direction in a tape (18) of superconducting material of a superconducting cable comprising the steps of:

- providing at least one tubular element (6) for supporting a tape (18) of superconducting material comprising a predetermined amount of metallic material, said tubular element (6) being in electrical contact with a tape (18) of superconducting material,

- spirally winding said tape (18) of superconducting material onto the surface of said at least one supporting tubular element (6),

- cooling the superconducting material to a temperature not higher than its critical temperature by means of a cooling fluid,

characterized in that it comprises the steps of:

- coupling at least one reinforcing foil (21) made of metallic material coupled to said tape (18) of superconducting material,

- determining the total amount of metallic material in electrical contact with the layer (20) of superconducting material in such a way that the maximum temperature reached by the superconducting material in case of short circuit is lower than the minimum temperature between the critical temperature of the superconducting material and the boiling temperature of said cooling fluid at the minimum working

pressure of said fluid.

18. Method according to claim 17, characterized in that the superconducting material of said tapes (18a, 18b) has a prestress degree along a longitudinal direction (γ) comprised between 0.05 and 0.2 %.

19. Method according to claim 17, characterized in that the tubular element is substantially composite and comprises a first metallic material and a second material associated to said first material and having a thermal expansion coefficient higher than that of said first material.

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